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Abert Squirrel Use of Ponderosa Pine as Feed Trees

Peter F. Ffolliott and David R. Patton[1]

The number of twigs found under ponderosa pine (*Pinus ponderosa*) were counted to determine Abert squirrel (*Sciurus aberti*) feed tree patterns and preferences on five Beaver Creek watersheds in Arizona. After 4 years of study, 56% of the feed trees were used 1 year in 4; 29% were used 2 years in 4; 13% were used 3 years in 4; and 2% were used in all 4 years. No pattern of feed tree selection within or among years studied was found; however, Abert squirrels preferred trees 14 to 22 inches in diameter, located in sites having 100 to 150 square feet basal area per acre. Silvicultural treatments had little effect upon feed tree selection.

Keywords: Abert Squirrel, ponderosa pine

Some foresters consider the Abert squirrel a destructive animal, because it commonly feeds on twigs and cones of ponderosa pine trees. However, the amount of damage is debatable (Coughlin 1938, Pearson 1950, Squillace 1953). Larson and Schubert (1970) were the first to document long-term twig and cone clipping of ponderosa pine by the Abert squirrel. They believed that high squirrel populations could preclude an adequate seed supply except in "bumper crop" years. Results from their north-central Arizona study indicated a 20% loss in cone production over a 10-year period.

There is some indication that Abert squirrels prefer particular trees for feeding (Farentinos 1972, Goldman 1928, Hall 1967, Keith 1965, Pearson 1950). It is not known why there is a choice, as those trees used do not appear different from trees which are not used. Keith (1965) suggested a qualitative difference, but neither Hall[2] nor Pederson et al. (1976) could document this difference in chemical analyses.

[1]*Ffolliott, is Professor, School of Renewable Natural Resources, University of Arizona, Tucson. Patton is Principal Wildlife Biologist, located at the Rocky Mountain Forest and Range Experiment Station, Forestry Sciences Laboratory at Tempe, in cooperation with Arizona State University; Station's central headquarters is maintained at Fort Collins, in cooperation with Colorado State University.*

[2]*Hall, J. G. 1967. The Kaibab squirrel in Grand Canyon National Park. A seven seasons summary 1960-1966. U.S. Dep. Inter., Natl. Park Serv., Grand Canyon, Ariz. Unpubl. rep. 54 p.*

Although heavy use of twigs and cones may be harmful to a given tree, there is recent evidence to indicate that feeding activities may be beneficial to a forest ecosystem through a nutrient transfer process. Working in a ponderosa pine forest in north-central Arizona, Skinner (1976) found that as much as 60 kg/ha of nitrogen could be transferred annually from twigs, cone parts, needles, and bark to the soil as a result of Abert squirrel feeding.

Because of conflicting views on the damage or use of ponderosa pine by Abert squirrels, more information is needed to document the feeding activity and how it changes over time. To this end, the USDA Forest Service and the University of Arizona initiated a cooperative study to determine: (1) if the same trees are selected for twig clipping from year to year; and (2) if the level of twig clipping activity varies from year to year in the same tree. Also, it was determined whether certain tree sizes are consistently selected for twig clipping, and if these trees are associated with specific forest density conditions.

Methods

All field data were collected on five watersheds (8, 10, 13, 14, and 17) within the Beaver Creek Watershed located on the Coconino National Forest in north-central Arizona (Brown et al. 1974). The area sampled totaled approximately 1,920 ha.

Twigs clipped by feeding squirrels were counted under the crowns of 1,390 permanently identified trees selected with a basal area factor (BAF) of 25 at 900 randomly located sample points. Both needled and peeled twigs were counted. Peeled twigs are definitely a characteristic of Abert squirrel feeding, while needled twigs are common to the feeding activities of both Abert and red squirrels (*Tamiasciurus hudsonicus mogollonensis*) (Rasmussen et al. 1975).

Twigs were counted each spring during 4 consecutive years (1973 through 1976), and feed trees were classified into one of four groups: none (0), light use (less than 10), moderate use (10-50), and heavy use (more than 50). Feed trees were defined as trees that had clipped twigs under their crowns. Cone parts were not included in the analysis.

Results

While different silvicultural treatments (thinning-shelterwood, patch cutting-thinning, group selection, irregular strip-shelterwood, and severe thinning) had been imposed on the five watersheds sampled (Brown et al. 1974), there were no differences in the field data collected during the study period. Therefore, all of the field data were grouped for analysis.

Of the 1,390 trees (approximately 18 cm in diameter and larger) examined, 65% were used as feed trees at least once during the 4-year period. Fifty-six percent of the feed trees were used 1 year in 4; 29% were used 2 years in 4; 13% were used 3 years in 4; and only 2 were used in all 4 years.

Under the 508 feed trees used 1 year in 4, fewer than 10 twigs were found beneath 80%, 10 to 50 twigs were found beneath 16%, and more than 50 twigs were found beneath 4%. Similar distributions in yearly twig counts were noted under feed trees used 2, 3, and 4 years.

There was no pattern to the selection of feed trees exhibiting light use within or among the years studied. Furthermore, while some trees were visited in consecutive years, other trees were only utilized once.

In contrast to this, a pattern suggesting a "rotation of use" seemed evident with trees exclusively characterized by moderate or heavy use. There, Abert squirrels did not usually return to the same tree each year, but instead alternated years of twig clipping with 2 or 3 years of no use. This latter observation is contrary to the use pattern described by Larson and Schubert (1970), who reported repeated twig clipping of the same tree year after year.

Infrequently, feed trees were subjected to moderate or heavy use in consecutive years. Trees were severely damaged only when this occurred. However, no tree mortality directly attributable to Abert squirrel feeding was observed during the study period.

Most of the twig clipping followed the pattern described by Pearson (1950), with Abert squirrels preferring the upper portions of tree crowns, especially terminals and upper laterals. In particular, loss of upper crown foliage was observed in the few trees under which large numbers of twigs (more than 50) were found in 2 or more consecutive years (fig. 1).

A

B

Figure 1. Loss of foliage in ponderosa pine feed trees under which more than 50 twigs were found in (A) 2 consecutive years, and (B) 3 consecutive years.

Identifying feed trees by size class showed that, while Abert squirrels fed in trees 8 to 34 inches in diameter, they selected 14 - to 22-inch trees, as reported earlier (Patton and Green 1970, Ffolliott and Patton 1975). The preferred size classes were similar on all study areas, suggesting that the silvicultural treatments imposed had little effect on feed tree selection.

In classifying feed tree sites in terms of surrounding forest density, approximately 85% of the sites examined were characterized by basal area levels between 75 and 175 square feet per acre, again independent of treatment. The highest percentage of sites were in the 100- to 150-square-foot range. Generally, tree sizes corresponding with those preferred by Abert squirrels as feed trees comprised most of the basal area.

Conclusions

This study indicates that Abert squirrels cause minimal damage in ponderosa pine. However, by understanding interactions between the squirrel and its selection of feed trees over time, a land manager may suggest forest management activities that can enhance the opportunities of feed tree occurrence (i.e., retaining preferred size classes and density levels).

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Agriculture — CSU, Fort Collins